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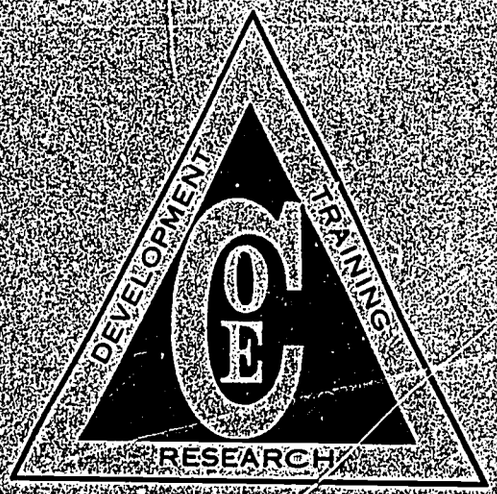
ABSTRACT

A key factor in educational planning is providing for an adequate and appropriate supply of teachers for future occupational education needs. This study develops an economic demand and supply model for vocational teachers in secondary schools, a model of the market for teacher services. Data for the study were taken from census reports and from State directors of vocational education in North Carolina, Georgia, and Tennessee. Variables used in the analysis included the number of employed teachers, average annual salary, related employment, education level, experience variables in developing models of the demand for and supply of teacher services and also demonstrate the difficulties in measuring the relationships involved. (MF)



A STUDY OF SUPPLY AND DEMAND FOR HIGH SCHOOL TEACHERS IN THREE SOUTHEASTERN STATES

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A STUDY OF SUPPLY AND DEMAND FOR HIGH SCHOOL VOCATIONAL TEACHERS IN THREE SOUTHEASTERN STATES

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PREFACE

The authors are indebted to several persons in the state departments of education involved in this study--A. G. Bullard, director of vocational education in North Carolina; George W. Mulling, director of vocational education in Georgia; Harry L. Bowman, director of research and statistical services in Georgia; and John W. Carney, director of administrative services in the division of vocational education in Tennessee--for their help in obtaining county data on the number of teachers, teacher salaries, and qualifications.

We also thank Ronald A. Schrimper for helpful suggestions concerning structure of the model, formulation of variables, and comments on an earlier draft. Others who made helpful suggestions include Robert Fearn, Paul Johnson, E. C. Pasour, Jim Seagraves and Dudley Wallace. However, any errors or omissions are solely our responsibility.

Mr. Max Strader obtained the primary data from Tennessee, and Miss Sophia Bernat was very helpful in tabulation of the data, coding and computer analysis. Mrs. Becky Benfield and Miss Paula Fields typed the original manuscript. Illustrations were prepared by Mrs. Teddy Kovac.

The Center and the authors owe appreciation to the entire Center technical, clerical, and editorial staff for their efforts in preparing the final report. Special thanks are due Mrs. Sue King for editing the manuscript and Miss Becky Beckler for typing the final copy.

John K. Coster
Director

SUMMARY

Providing for an adequate and appropriate number of teachers for future occupational education needs is one key factor in educational planning. This study develops a model of the market for the services of occupational education teachers, defines the supply and demand relationships involved in occupational education planning, and seeks to measure these relationships as they operate in the model.

The data for the study were obtained from census reports and state directors of vocational education in North Carolina, Georgia, and Tennessee. The variables used in the analysis included number of employed teachers, average annual salary, high school enrollments, employment in occupations related to the available occupational schooling, education level of teachers, teaching and related work experience, and a measure of the "opportunity costs" of teaching.

The results of the study suggest that economic variables are important in developing models of the demand for and supply of teaching services in occupational education. They also indicate the difficulty involved in measuring supply and demand. It is hoped that this study will stimulate further, more extensive research into these relationships.

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INTRODUCTION

Conscious efforts to speed up economic development have stimulated greater interest in the economics of education. Recent studies of the economic aspects of occupational education have contributed to a general consensus that such schooling is an activity which is a fundamental part of economic development.[1] Consequently, there is a growing interest in planning for occupational education as a means of ensuring that it is carried on in an orderly and efficient manner (Thomas, 1966).

One central issue in educational planning is the possibility of a "shortage" or a "surplus" of adequately trained teachers. Providing for the appropriate supply of qualified teachers is a key element in educational planning. Thus, Hansen (1965) feels that educators and economists should give more attention to determinants of the supply of and demand for teachers. Educational planners should understand how the markets for teachers function, i.e., they should understand the factors determining the number of teachers sought and the number of teachers offering to teach at alternative salary levels.

Previous attempts to analyze supply and demand for teachers have generally involved technical models which excluded economic variables. Such efforts frequently represent improper use of the economic terms "supply" and "demand." For example, the number of teachers that will be needed at a future date is usually estimated by dividing a fixed student-teacher ratio into projected enrollments. Unfortunately, such numbers are frequently cited or referred to as the "future demand" for teachers.

Likewise, the number of persons projected to be teaching at some future date is often erroneously referred to as the "future supply." Estimates of the number of persons who will be teaching at some future time generally are made by adjusting the number of teachers currently employed for expected gains and losses. Estimated change in the number of employed teachers includes the number of additional persons projected to qualify for teaching (adjusted for the historical proportion not entering teaching), plus transfers of persons qualified to teach but currently employed in other occupations, minus losses due to mortality, retirement, and transfers from teaching to other occupations (Cartter, 1966; Folger, 1966).

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[1]Examples of recent economic analysis of various kinds of occupational education include Borus (1964), Carroll and Ihnen (1967), Corazzini (1967), Pejovich and Sullivan (1966), and Somers and Stromsdorfer (1964).

Projections of the number of teaching positions or of teacher employment as of a future date are exactly that and nothing more--certainly not projections of supply or demand. Such projections may be satisfactory for some purposes, but one essential quality of supply and demand analysis is missing. The technical models do not include economic variables that permit estimation of price-quantity relationships.[2]

Consequently, projections of teacher positions and teacher employment based on historical ratios may obscure rather than provide knowledge regarding supply and demand relationships for teachers. Such projections provide no information about the annual quantity of teaching services that would be purchased or the quantity that would be offered for hire at alternative salary levels. Similarly, no information is provided on the absolute or relative importance of factors which can cause the supply or demand for teachers to change. Not only are the projections unrepresentative of supply and demand, but, according to Blank and Stigler (1957, pp. 19-22), the projections can be very inappropriate because the conditions of supply and demand may change.

Kershaw and McKean (1962) summarize, in the following quotation, their evaluation of the shortcomings of previous efforts to examine the question of supply and demand for teachers.

> "In the literature on teacher salaries the terms supply and demand appear frequently enough, but almost always in a quite mechanistic way: so many children will create such and such a demand for teachers, so many college graduates create such and such a supply of teachers. But rarely is attention given to the competing demands for teachers or potential teachers or to what the quantities supplied or demanded might be in modified circumstances or under modified salary policies." (p. 21)

Hansen (1965) reached the same conclusion and pointed out the danger of educational planning of any kind based on such a state of ignorance. There is considerable risk that educational planning without adequate knowledge of the determinants of demand and supply of educational resources may cause more problems than will be solved.

The objectives of this study are (1) to develop a model of the market for the services of occupational education teachers, i.e.,

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[2]In economics, supply is defined as the schedule of quantities that would be offered for sale during a given period of time for various levels of price, other factors held constant. Demand is the schedule of quantities that would be purchased during a given period of time for various levels of price, other factors held constant.

specify the demand and supply relationships, and (2) to obtain empirical measures of these supply and demand relationships.

The market for public school teachers has some characteristics which make supply and demand analysis difficult, even though these same characteristics are often common to other markets. One problem in studying the market for teachers is the variations in quality. Demand and supply analysis would be simplified if teachers were homogeneous. Since teachers are not homogeneous, the researcher must somehow standardize or measure the importance of quality differences among teachers.

A second problem arises from the fact that the human agent is generally capable of rendering services at a satisfactory level for employment in a large number of occupations. Even though qualified to teach, many persons with these qualifications may never choose to teach. Teachers are employed in many different occupations, which causes difficulty in quantifying the opportunity cost of teaching.[3]

A third problem exists because the market for public school teachers is highly institutionalized. Decisions about the number of teachers sought and the salary range for each teaching position (both quantity and price) are usually made by public school officials, school boards, and federal, state, and local government officials. These groups act as intermediaries between the demanders of teaching services (parents and students) and the suppliers (teachers).

The decisions made by public officials concerning teaching positions and salaries do not represent an exercise of strong monopsony power because teachers have occupational alternatives. If the price is set too low or the quantity demanded is larger than the quantity that will be supplied at the set price, either (1) teaching positions will go unfilled, or (2) positions will be filled with personnel who are less fully qualified. Therefore, institutionally determined salaries for public school teachers can be set only as low as will bring forth the desired number of teachers. If supply has been overestimated, condition (1) or (2) will exist.

In the present study the strictly mechanical approach, i.e., use of fixed coefficients to project positions or employment for vocational teachers, has been intentionally avoided. Likewise, administrators of occupational education have not been asked to supply any estimates of how many vocational teachers will be needed or supplied at some future time.

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[3]The opportunity cost of employment in one occupation (such as teaching) is the maximum amount of real income that could be earned in another occupation. Besides salary, real income includes such things as fringe benefits and working conditions which are part of the opportunity cost. If opportunity cost for a teacher is greater than real income in teaching, the teacher will change jobs--affecting supply.

Research in occupational education should help the administrators plan for future needs by increasing their understanding and knowledge of the forces at work in the market for teachers. A survey of their past plans or a compilation of their current opinions can hardly be expected to provide much assistance.

DESIGN

The approach taken in this study has been an economic one. If occupational education is to prepare people for an occupation, then there should be identifiable factors (such as opportunities for employment) that are related to the demand for occupational education and the demand for teachers in occupational education. Similarly, if there is a "shortage" of adequately trained teachers for occupational education, there surely must be identifiable measures which can be taken to overcome the "shortage." The present study was undertaken to see if significant relationships can be identified and measured by formulation and empirical testing of an economic demand and supply model for vocational teachers in secondary schools. The first step in the development of the model was the enumeration of the factors to be considered.

Factors Affecting the Demand for Teacher Services

The demand for teacher services is derived from the demand for schooling (Hansen, 1965). Since both investment and consumption aspects of education may influence a person's choice of type and level of schooling, many factors can affect the demand for schooling and, hence, the demand for teachers.[4] Some important variables that would affect the aggregate demand for education as consumption are (1) population, (2) income, (3) tastes, and (4) prices of related consumption items. Factors affecting the aggregate demand for education as an investment are (1) the amount and distribution of costs and returns over time (direct and indirect)[5], (2) the social rate of time preference for current consumption (rate of discount), and (3) the number of potential investors (number of people who can capitalize on the investment opportunity).

The demand for vocational education may be partly for consumption, but one would normally think of vocational schooling as preparation for employment. Thus, the demand for vocational teachers would be derived primarily from the demand for occupational education as an investmant.

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[4]Campbell and Siegel (1967) provide some empirical evidence that demand for education can be influenced by both consumption and investment considerations.

[5]The internal rate of return of an investment is determined by the amount and distribution of costs and returns over time. Capital value of the investment can also be determined if the appropriate rate of discount is known.

Hence, the factors affecting the profitability of occupational schooling as an investment should be closely related to the demand for vocational teachers.

Factors Affecting the Supply of Teacher Services

The maximum potential quantity of teacher services at any point in time would be realized if all the qualified teachers were fully employed in teaching positions. However, many persons qualified to teach are in nonteaching occupations.

The important factor affecting the number of teachers that are willing to teach is the opportunity for higher real income (including value of fringe benefits and working conditions) in nonteaching occupations. The value of the nonteaching opportunity is determined by the demand and supply conditions in the nonteaching labor markets and the individual's personal preferences and qualifications, such as education and experience. Thus, the short-run flow of teacher services is not influenced by the costs of qualifying to teach. Once incurred, the cost of qualifying to teach becomes a fixed cost and is no longer relevant to the decision to teach or select an alternative occupation.

Since, however, the number of persons considered to be qualified for teaching does constitute a constraint on the maximum flow of teacher services available in the short run, there is some reason to be concerned about the long-run flow of qualified teachers from institutions of higher education. Higher salaries for teachers would obviously encourage more young people to invest in qualifying for a career in teaching. Even so, there is a time lag of at least one year before any substantial number of college enrollees who change their plans from nonteaching to teaching can qualify. High school students and graduates planning to attend college might also change their occupational choice to teaching if the salaries were made more attractive. However, there is a time lag of four or more years before the number of qualified teachers can be affected by this group.

The model developed in this study does not attempt to explain the flow of qualified teachers from institutions of higher education. It is a short-run model which is designed only to measure supply and demand for high school vocational teachers as a flow of teacher services (represented by the number of persons actually employed as vocational teachers).

Model Elements

The following model elements are used in this study:

(1) f = demand for secondary vocational teachers, as a function of number of teachers, salary, high school enrollment, employment in related occupations

(2) g = supply of secondary vocational teachers, as a function of number of teachers, salary, education, experience, mean income per median years of schooling

Number of teachers and salary were treated as endogenous and the other variables as exogenous. Counties were used as the unit of observation. Separate regressions were run for several types of vocational teachers: vocational agriculture, home economics, distributive education, etc. The data used were collected for three states--North Carolina, Georgia, and Tennessee.

1. Teachers (Q) are simply the number of persons employed to teach a particular type of secondary vocational training in the public schools of a county.

2. Salary (P) is the average annual teaching salary earned by the teachers. The annual term of employment associated with salary varies, but most of the variation is between types of vocational teachers rather than within. Consequently, salaries for each type of vocational teacher were averaged without adjustment.

3. High school enrollment in a county (S) is a measure of the quantity of students that may be in the process of choosing a particular vocation and the corresponding type of vocational training. It represents the "population" of potential investors in vocational schooling. Other things equal, the larger the number of students the larger will be the number with tastes and preferences for a specific vocation and greater will be the demand for teachers of that type of vocational schooling. Thus, high school enrollment was expected to have a positive relationship to quantity of vocational teachers because investment in, and consumption of, vocational training would tend to increase with enrollment.

4. Employment in occupations related to a particular type of vocational schooling (N) was used as a proxy for county variations in the investment value of the vocational schooling. Ideally, measures of county variation in rates of return to the different types of high school curricula (vocational and nonvocational) would better indicate the value of the investment opportunity in a high school vocational program, and the level of demand for that type of schooling. Such comprehensive data are not available.

The greatest drawback to related employment in the demand equation is the lack of assurance that past (or even current) employment in a vocation is positively correlated with rates of return for training in that vocation. Nevertheless, the sheer size of the labor force in a particular vocation would indicate the past employment opportunities and may also be used as an indicator of future employment opportunities by high school students choosing vocational training.

Vocations associated with occupations experiencing declining employment levels, such as farming, apparently offer relatively low

rate-of-return possibilities on the average, but the expected rate of return to particular types of students may be relatively high. Thus, there is still a demand for vocational agriculture at the high school level. This demand may be as closely associated with the number of students growing up on farms as with the actual rate-of-return possibilities, about which students may have relatively imprecise information. Thus, the employment variable, which was used because of a lack of information on rates-of-return, may have an important relationship to the demand for vocational schooling simply because student decisions are made without perfect knowledge.

5. Education of teachers (E) was measured as the average number of years of formal schooling obtained by the high school vocational teachers. People with more formal schooling tend to have higher opportunity costs, because with more formal schooling persons qualified to teach can obtain employment at higher salaries even in nonteaching jobs.

6. Experience (X) was measured as the years of teaching or related employment acknowledged for purposes of certification and pay. Like years of formal schooling, experience tends to raise the opportunity costs of teaching.

Nonteaching or related work experience would have been included to help reflect opportunity costs if the data had been available. However, payroll information did not include years of employment that is unrelated to teaching. Age was also unavailable, but age might be a fairly good measure for total labor force experience. Periods of nonparticipation in the labor force caused by variation in years of schooling or, in the case of women teachers, years of being a full-time housewife would reduce the correlation between age and total labor force experience.

7. Another variable (W) was included as a partial measure of the opportunity costs of teaching. The variable is the ratio of mean income (for income recipients in the county) to the median years of schooling of county residents 25 years of age or older. Since school teachers have higher-than-average schooling, their potential earnings in nonteaching occupations are largely dependent upon the supply and demand for persons with college education. Average salaries of college graduates would probably be the best indicator of the alternative income potential of teachers, but these data are not available by county. The average income per median year of schooling was used. Counties with higher income per year of schooling were assumed to be counties that represent higher income potential for college graduates. Thus, opportunity costs for teachers would be reflected by the variable.

Since neither mean income nor median years of schooling describes the distribution of values, there is no way to determine if the ratio of earnings to years of schooling varies with the level of schooling. Thus, the authors do not know if this variable is closely correlated with the income potential of college graduates. The variable is obviously not an ideal measure of the income potential of teachers in nonteaching occupations, but it should supplement years of schooling and related work

experience of teachers as factors related to county variations in the opportunity costs of teaching.

Data

The number of secondary vocational teachers by county and type of vocational program for each of the three states was supplied by the state directors of vocational education. The state directors also provided information on certification for each teacher so that education and years of teaching or related experience could be determined. Thus, the number of teachers per county, their average years of schooling, and average years of teaching or related experience could be determined for each program (vocational agriculture, home economics, etc.).

The teacher data supplied for North Carolina counties were for the school year 1965-66. Georgia and Tennessee data were for vocational teachers in the academic year 1966-67. High school enrollment data were for the same academic year as the teacher data in North Carolina and Georgia. High school enrollment for the academic year 1965-66 was used for Tennessee because data for the following year could not be readily obtained. The distribution of high school enrollment by county probably changed very little in one year.

Other information, such as related employment per county, mean earnings of income recipients, and median years of schooling for persons 25 years of age or older, was obtained from published census reports. With only one exception (1965 employment in contract construction in Tennessee), such data were for 1960.

RESULTS

The two-equation model is overidentified according to the rules of identification.[6] The demand equation is over-identified by a factor of one, and the supply equation is over-identified by a factor of two. Both functions were estimated by two-stage least squares. In the first stage, number of teachers and salaries (the two endogenous variables) were each regressed on all the exogenous variables. Thus, there were two first-stage equations for each type of vocational teacher for each of the three states. The equations were in the following form:

$$Q = A_o + b_1 N + b_2 E + b_3 X + b_4 S + b_5 W$$

$$P = a_1 + c_1 N + c_2 E + c_3 X + c_4 S + c_5 W$$

Results of the first-stage equations are presented in Tables 1-3. The exogenous variables were associated with a fairly large amount of the variation in number of vocational teachers and salaries. There were substantial differences; however, in the proportion of variation associated with exogenous variables for different types of vocational teachers. The R^2's obtained in the first-stage regressions were relatively low for salaries of distributive education teachers and number of diversified and comprehensive teachers in North Carolina (Table 1). In contrast, exogenous variables "explained" a very high proportion of the county variation in salaries for North Carolina vocational agriculture teachers and the county variation in number of distributive education teachers in Georgia (Tables 1 and 2).

Data for each exogenous variable in each county were used in the first-stage regression equations to obtain a predicted quantity of each type of vocational teacher and a predicted average salary. The predicted values were then used in the second-stage regressions. Demand and supply were estimated using a linear form of the two equation model such that

$$\text{(Demand)} \quad Q_d = a_2 + d_1 S + d_2 N + d_3 P^*$$

$$\text{(Supply)} \quad P_s = a_3 + g_1 E + g_2 X + g_3 W + g_4 Q^*$$

where the asterisk (*) indicates values predicted from the first-stage regression equations.

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[6] Rules of identification and several procedures for estimating parameters for an over-identified model can be found in econometric textbooks.

Table 1. First-Stage Regression Equations with Quantity and Price Regressed on the Other Variables in the Model, by Vocational Subject, North Carolina, 1965-66

Program	Dependent Variable	Constant	N	E	X	S	W	Standard Error of Regression	R^2	Observations
Vocational Agriculture	Q	13.28	.00507 (.00039)[a]	-.88827 (.54877)	.02335 (.13359)	.00026 (.00008)	.00947 (.00687)	2.24	.74	99
	P	2767.66	-.11 (.02)	176.60 (31.95)	197.10 (7.78)	.06 (.005)	-1.37 (.40)	130.62	.94	
Home Economics	Q	-2.28	.00352 (.00038)	-.08380 (.70538)	-.04654 (.09344)	.00103 (.00008)	.02170 (.0067)	2.18	.85	98
	P	290.02	-.03 (.04)	259.83 (69.87)	158.79 (9.26)	.05 (.01)	.19 (.66)	215.88	.84	
Trades and Industry	Q	3.60	.14413 (.12812)	-.29283 (.32090)	-.22503 (.19884)	.00078 (.00024)	.01368 (.01679)	3.68	.55	75
	P	2101.80	-1.87 (13.87)	137.68 (34.74)	149.38 (21.52)	.05 (.03)	2.14 (1.81)	398.35	.70	
Distributive	Q	5.69	.00053 (.0001)	-.50635 (.24885)	-.03456 (.04225)	-.00005 (.00015)	.01272 (.00396)	1.08	.88	61
	P	-12271.00	-.03 (.26)	910.94 (599.73)	137.66 (101.83)	-.02 (38)	10.17 (9.56)	2602.87	.13	
Diversified and Comprehensive	Q	4.52	.02981 (.02028)	-.18217 (.17277)	-.04657 (.07574)	.00008 (.0002)	.00268 (.00586)	1.71	.34	68
	P	4974.72	7.77 (3.62)	-31.47 (30.81)	150.66 (13.51)	-.02 (.04)	-1.14 (1.05)	304.34	.71	

[a]Number in parentheses is the standard error corresponding to the coefficient immediately above.

Table 2. First-Stage Regression Equations with Quantity and Price Regressed on the Other Variables in the Model, by Vocational Subject, Georgia, 1966-67

Program	Dependent Variable	Constant	N	E	X	S	W	Standard Error of Regression	R^2	Observation
Vocational Agriculture	Q	-1.50	.00038 (.00004)[a]	.12487 (.16405)	.00351 (.00874)	-.000002 (.000024)	.00210 (.00172)	.75	.46	145
	P	-11263.00	.02 (.02)	1072.91 (109.06)	35.33 (5.81)	.05 (.02)	3.88 (1.15)	497.06	.57	
Home Economics	Q	-4.46	.23283 (.03965)	.290 (.673)	-.01522 (.03601)	.00015 (.00009)	.00279 (.00639)	2.48	.46	143
	P	-4548.90	-10.61 (6.91)	584.23 (115.63)	64.53 (6.18)	.04 (.01)	3.69 (1.10)	426.02	.60	
Trades and Industry	Q	35.08	-.00045 (.00170)	-2.01101 (.28532)	.08939 (.0351)	.00064 (.00028)	-.00948 (.00782)	1.59	.87	42
	P	-1047.06	.60 (.63)	431.91 (104.82)	49.81 (12.90)	-.13 (.11)	4.75 (2.88)	582.63	.69	
Distributive	Q	-14.85	.00122 (.00053)	.92661 (.57718)	-.04210 (.01918)	.00013 (.00014)	.00240 (.00411)	.66	.96	22
	P	-18680.00	-.60 (.67)	1499.15 (717.86)	38.11 (23.86)	.19 (.17)	2.48 (5.12)	825.61	.58	
Business and Office	Q	4.86	.01666 (.01282)	-.32716 (.24954)	.03791 (.03236)	-.00003 (.00021)	.00318 (.00921)	1.22	.71	26
	P	6214.52	8.66 (7.91)	-139.82 (153.91)	53.51 (19.96)	-.12 (.13)	8.72 (5.68)	753.43	.43	

[a]Number in parentheses is the standard error corresponding to the coefficient immediately above.

Table 3. First-Stage Regression Equations with Quantity and Price Regressed on the Other Variables in the Model, by Vocational Subject, Tennessee, 1966-67

Program	Dependent Variable	Constant	N	E	X	S	W	Standard Error of Regression	R^2	Observations
Vocational Agriculture	Q	.93	.31773 (.04154)[a]	-.3988 (.41818)	-.00005 (.02179)	.00009 (.00003)	.00200 (.00311)	1.39	.50	91
	P	-1204.78	-18.76 (11.90)	399.02 (119.77)	32.34 (6.24)	.06 (.01)	3.17 (.89)	398.96	.64	
Home Economics	Q	60.90	.09862 (.05774)	-3.62181 (1.90687)	.00190 (.06891)	.00107 (.00013)	-.00746 (.00875)	3.79	.77	88
	P	2118.77	-3.58 (5.05)	171.84 (166.82)	28.11 (6.03)	.04 (.01)	2.90 (.77)	331.78	.57	
Trades and Industry[b]	Q	-8.78	.00108 (.001)	.53429 (.72077)	-.03193 (.07530)	.00074 (.00036)	.00577 (.00991)	3.68	.83	55
	P	3330.76	.13 (.12)	120.26 (87.97)	34.34 (9.19)	-.01 (.04)	-12.83 (1.21)	449.70	.53	
Distributive	Q	2.84	-.00063 (.00026)	-.17390 (.98087)	.08697 (.06278)	.00073 (.0002)	-.00083 (.00426)	1.28	.80	31
	P	-7961.26	.24 (.09)	772.58 (344.13)	35.96 (22.03)	-.17 (.07)	5.56 (1.50)	450.19	.69	
Business and Office	Q	6.90	-.00027 (.00012)	-.48598 (.95440)	-.02289 (.04984)	.00070 (.00015)	.00655 (.00589)	1.49	.87	27
	P	9672.42	.06 (.04)	-257.35 (303.92)	69.31 (15.87)	-.06 (.05)	-.27 (1.88)	474.78	.70	

[a]Number in parentheses is the standard error corresponding to the coefficient immediately above.

[b]The trades and industry regression also contained, as a variable, the ratio of earnings in contract construction to earnings in all employment. Coefficients of the variable were not significant in first- or second-stage regressions.

Results of the estimation of supply and demand equations are presented and discussed for the three states in the same order that data and results were obtained--North Carolina, Georgia, Tennessee. Results obtained for an individual program in one state are not strictly comparable because of changes in the model and in the formulation of some of the variables. Nevertheless, data for Georgia and Tennessee did facilitate testing of models very similar to the one used in North Carolina.

North Carolina

The demand equations estimated for five types of secondary vocational teachers in North Carolina are given in Table 4. More than two-thirds of the variation in number of vocational teachers per county was associated with the three independent variables for three of the five types of teachers. In all five equations the independent variables were related to the number of teachers as expected, with one exception. High school enrollment had an inverse, but not significant, relationship to demand for distributive education teachers. In all five equations the salary was inversely related to the quantity of vocational teachers, but the price coefficients were not significant at the .05 level.

Demand schedules normally have a negative slope because of the tendency toward larger purchases of goods or services as price is reduced (other things unchanged). The linear demand equations estimated for teachers in the five vocational programs in North Carolina are given in Figure 1.

Elasticity of demand is computed as the percentage of change in quantity demanded per one percent change in price.[7] When a one percent change in price can cause a proportionately larger change in quantity demanded, the elasticity is some negative number with an absolute value greater than one, and demand is said to be elastic. Inelastic demand is characterized by an elasticity coefficient between 0 and -1.0. The estimated demand for trades and industry teachers was elastic for average quantity and salary (Table 5). Estimated county demand for the other types of vocational teachers in North Carolina was inelastic. The negative slope of a linear demand schedule increases the more inelastic is the demand (Figure 1).

High school enrollment per county and related employment were both positively associated with quantity of vocational teachers. Other things equal, the counties with larger high school enrollments and greater employment in related occupations tended to have greater demand for the specific type of vocational schooling and corresponding type of vocational teachers. Thus, the size of the population of potential investors and the

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[7]The elasticity coefficients in this report are for the point of average price and quantity and would not be accurate for other price and quantity combinations in the demand (or supply) schedules. The following equation was used in computing the elasticities:

$$\Sigma = \frac{dq}{dp} \cdot \frac{\bar{P}}{\bar{Q}}$$

Table 4. Demand Equations for Secondary Vocational Teachers in North Carolina, by Type of Program, 1965-66

Program	Constant	High School Enrollment S	Related Employment[a] N	Annual Salary P	Standard Error	R^2	Observations
Vocational Agriculture	5.04	.00036 (.000078)[c]	.00478 (.00038)	-.00051 (.00052)	2.27	.72	99
Home Economics	3.81	.00119 (.000079)	.00308 (.00037)	-.0004 (.00054)	2.28	.83	98
Trades and Industry	9.52	.00074 (.00023)	.0227 (.0093)	-.00145 (.00094)	3.68	.54	75
Distributive	1.20	-.00005 (.00017)	.00055 (.00012)	-.00011 (.00016)	1.22	.84	61
Diversified and Comprehensive	3.96	.00009 (.00020)	.03184 (.02062)	-.00037 (.00049)	1.70	.33	68

[a]Measures of county variation in related employment consisted of the following: Agriculture and Home Economics--1960 rural farm population (units of 10); Trades and Industry--1960 employment in construction and manufacturing (units of 100); Distributive--1960 employment in trade, finance, insurance and real estate; Diversified and Comprehensive--1960 urban population (units of 1,000).

[b]Price predicted by first-stage regression equation.

[c]Number in parentheses is the standard error corresponding to the coefficient immediately above.

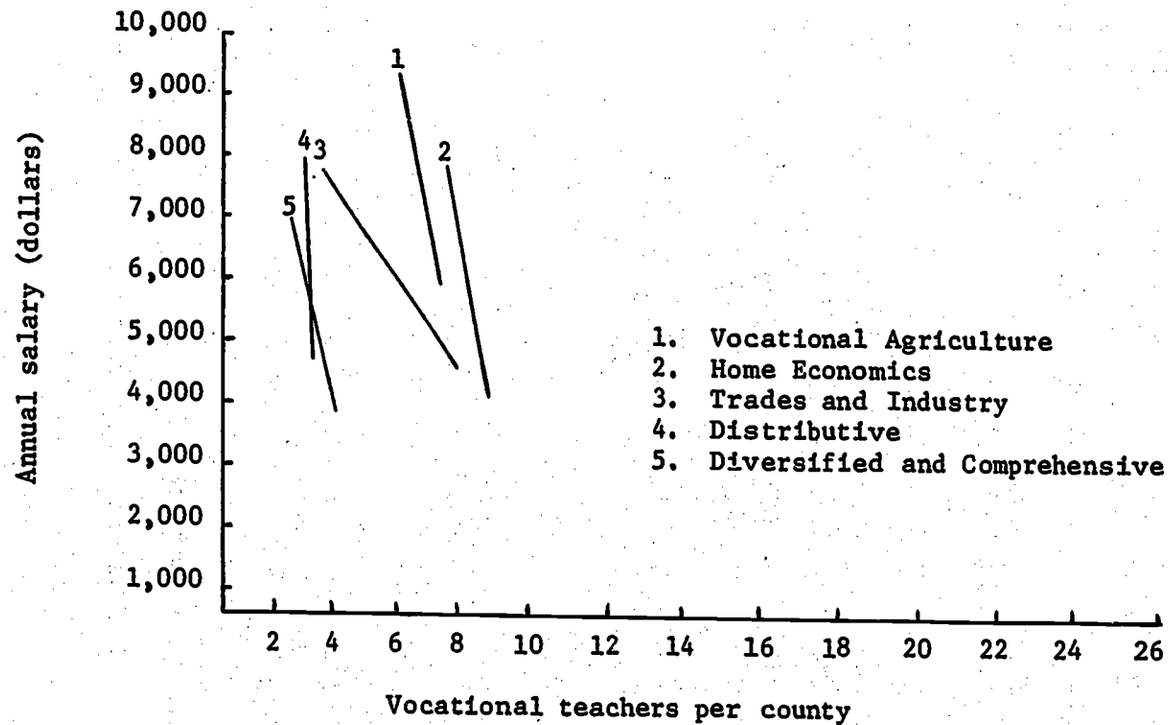

Figure 1. County Demand for Secondary Vocational Teachers in North Carolina, 1965-66

Table 5. Demand Elasticities for Average Salary and Quantity of Vocational Teachers Per County in North Carolina, by Program, 1965-66

Program	Elasticity[a]	Average Price	Average Quantity
		(dollars per year)	
Vocational Agriculture	-.59	7417	6.36
Home Economics	-.31	6055	7.94
Trades and Industry	-1.46	5839	5.79
Distributive	-.25	6072	2.70
Diversified and Comprehensive	-.66	5218	2.94

[a]A negative elasticity means that price and quantity are inversely related (i.e., there would be a tendency for fewer teachers to be hired at a high price than at some lower price).

size of the labor force in related occupations apparently have a measurable effect on the demand for secondary vocational teachers. However, the standard errors were much too large in some cases to place confidence in the coefficients.

The supply equations estimated for North Carolina were formulated with average salary as the dependent variable. Average salary was expressed as a function of predicted quantity of vocational teachers, average years of formal schooling, work experience of teachers, and the ratio of mean earnings by income recipients to median years of schooling for county residents 25 years of age or older (Table 6). As previously explained, the latter variable was used as a measure of the earning potential of teachers because of county labor market conditions which could affect the demand for highly educated people.

Four of the supply equations estimated for vocational teachers in North Carolina were reasonable in that results were consistent with economic theory. However, the supply equation estimated for distributive education teachers was unsatisfactory for two reasons: (1) only a very low proportion (.13) of the county variation in average salaries was associated with variations of the four independent variables; and (2) the negative relationship between quantity of teachers and average salary was

Table 6. Supply Equations for Secondary Vocational Teachers in North Carolina, by Type of Program, 1965-66

Program	Constant	Years of Schooling E	Years of Experience X	Alternative Earnings W	Quantity of Teachers Q[a]	Standard Error	R^2	Observations
Vocational Agriculture	2545.23	150.28 (48.76)[b]	206.52 (11.82)	.99 (.52)	8.37 (5.58)	199.84	.85	99
Home Economics	-633.02	301.75 (73.40)	159.78 (9.86)	.86 (.64)	27.09 (5.21)	229.78	.81	98
Trades and Industry	2115.20	150.38 (34.37)	161.42 (21.11)	.83 (1.52)	43.04 (14.80)	398.75	.70	75
Distributive	-11776.31	867.17 (564.32)	135.63 (100.89)	11.10 (10.13)	-74.49 (139.57)	2579.12	.13	61
Diversified and Comprehensive	4134.37	-.20 (30.64)	160.53 (13.46)	-1.55 (1.08)	167.82 (35.93)	302.86	.71	68

[a]Quantity predicted from first-stage regression equation.

[b]Number in parentheses is the standard error corresponding to the coefficient immediately above.

not consistent with the economic theory of supply. Supply schedules for the four other types of teachers are illustrated in Figure 2.

The supply elasticities for secondary vocational teachers were very high (Table 7). However, the supply of vocational teachers for counties was probably much more elastic than the supply for states. A small increase in salary for a particular type of vocational teacher (through a county supplement) may cause a large increase in the number of such vocational teachers willing to teach in that particular county. A uniform increase in salaries of vocational teachers for all counties of North Carolina would not result in such relatively large increases in the number of vocational teachers available to the state.

County supplements probably help attract new and experienced teachers into counties paying supplements as well as encouraging qualified teachers to change from nonteaching occupations to teaching. The latter change would also occur with statewide increases in salary, but the size of response due to migration would depend on interstate mobility of teachers. Interstate migration of teachers is probably low relative to county migration. Thus, elasticities of supply of vocational teachers for a state would surely be lower than those presented in Table 7.

It is also possible that the value of fringe benefits is somewhat higher in counties which pay higher salaries. If counties that pay higher salaries do provide more fringe benefits, the elasticities of supply are overestimated. The estimated change in quantity of teachers as a response to changes in salary is actually a response to change in salary and fringe benefits.

Georgia and Tennessee

Demand equations estimated for Georgia and Tennessee were less satisfactory than for North Carolina. None of the price coefficients had a high level of significance in the North Carolina demand equations, but all were negative as expected. In the Georgia and Tennessee demand equations half of the price coefficients were negative (Tables 8 and 9). Only one of the negative coefficients was significant at the .05 level of probability.

Alternative measures of related employment were tried for home economics, distributive education, and trades and industry programs. Demand equations for Georgia and Tennessee did not appear to be improved by the substitute measures of related employment. Slightly better results might have been obtained if the related employment variables had been the same as those used for North Carolina.

Supply equations estimated for Georgia and Tennessee were similar to those for North Carolina; although highly significant in only two cases, the coefficient for quantity of teachers was positive in nine of the ten supply equations (Tables 10 and 11). Thus, the estimated relationship between price and quantity was positive.

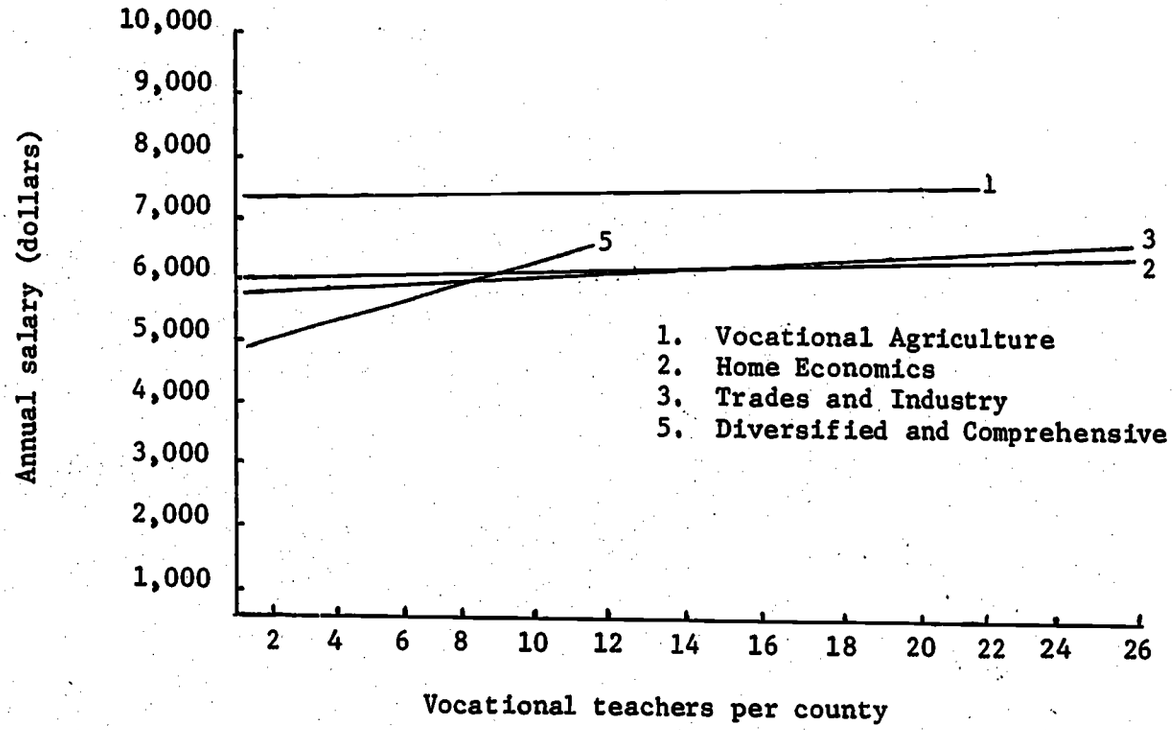

Figure 2. County Supply of Secondary Vocational Teachers in North Carolina, 1965-66

Table 7. Supply Elasticities for Average Salary and Quantity of Vocational Teachers Per County in North Carolina, by Program, 1965-66

Program	Elasticity	Average Price	Average Quantity
		(dollars per year)	
Vocational Agriculture	139.30	7417	6.36
Home Economics	28.15	6055	7.94
Trades and Industry	23.43	5839	5.79
Diversified and Comprehensive	10.57	5218	2.94

Table 8. Demand Equations for Secondary Vocational Teachers in Georgia, by Type of Program, 1966-67

Program	Constant	High School Enrollment S	Related Employment[a] N	Annual Salary P[b]	Standard Error	R^2	Observations
Vocational Agriculture	-.01	-.000001 (.000023)[c]	.00037 (.000035)	.00014 (.00012)	.74	.46	145
Home Economics	1.00	.00016 (.000089)	.24024 (.036)	-.00005 (.00045)	2.47	.46	143
Trades and Industry	13.53	.00059 (.00038)	-.00004 (.0022)	-.00158 (.00045)	2.10	.76	42
Distributive	1.05	.0001 (.00015)	.00131 (.00058)	-.00009 (.00021)	.72	.95	22
Business and Office	-4.57	.00004 (.00017)	.0097 (.01083)	.00079 (.00052)	1.19	.70	26

[a]Measures of county variation in related employment consisted of the following: agriculture--1960 rural farm population; home economics--1960 rural population (units of 1,000); trades and industry--1960 employment in construction and manufacturing; distributive--1960 employment in trade, transportation, finance, insurance, real estate, communications and other public utilities; business and office--1960 urban population (units of 1,000).

[b]Price predicted from first-stage regression equation.

[c]Number in parentheses is the standard error corresponding to the coefficient immediately above.

Table 9. Demand Equations for Secondary Vocational Teachers in Tennessee, by Type of Program, 1966-67

Program	Constant	High School Enrollment S	Related Employment[a] N	Annual Salary P[b]	Standard Error	R^2	Observations
Vocational Agriculture	.37	.00009 (.000045)[c]	.31614 (.04)	.00006 (.00043)	1.38	.50	91
Home Economics	16.20	.00119 (.00015)	.08206 (.05)	-.00256 (.0016)	3.81	.76	88
Trades and Industry[d]	-2.37	.00084 (.00034)	.00077 (.00097)	.00051 (.0016)	3.65	.82	55
Distributive	-3.13	.00077 (.00020)	-.00069 (.00027)	.00056 (.00046)	1.30	.78	31
Business and Office	3.99	.00063 (.00015)	-.0002 (.00013)	-.00057 (.00059)	1.48	.86	27

[a]Measures of county variation in related employment consisted of the following: agriculture--1960 rural farm population (units of 1,000); home economics--1960 rural population (units of 1,000); trades and industry--1965 employment in contract construction; distributive--1960 employment in finance, insurance, real estate, transportation, communication, and other public utilities; business and office--1960 employment in manufacturing.

[b]Price predicted from first-stage regression equation.

[c]Number in parentheses is the standard error corresponding to the coefficient immediately above.

[d]The ratio of 1965 wages in contract construction to average wages for the county was also included in the trades and industry demand equation. However, the coefficient was not significant.

Table 10. Supply Equations for Secondary Vocational Teachers in Georgia, by Type of Program, 1966-67

Program	Constant	Years of Schooling E	Years of Experience X	Alternative Earnings W	Quantity of Teachers Q[a]	Standard Error	R^2	Observations
Vocational Agriculture	-11449.00	1056.99 (112.53)[b]	38.02 (6.00)	5.47 (1.05)	61.30 (64.19)	514.97	.54	145
Home Economics	-5270.30	619.22 (119.42)	66.23 (6.32)	3.81 (1.16)	15.84 (21.43)	437.97	.57	143
Trades and Industry	409.84	332.43 (136.23)	56.38 (13.66)	5.32 (2.47)	-61.07 (35.73)	581.28	.68	42
Distributive	-16703.00	1356.37 (710.87)	47.30 (22.97)	4.16 (4.87)	69.43 (67.91)	826.91	.56	22
Business and Office	5928.22	-80.39 (148.26)	47.21 (20.98)	5.63 (4.80)	137.73 (110.82)	747.95	.41	26

[a] Quantity predicted from first-stage regression equation.

[b] Number in parentheses is the standard error corresponding to the coefficient immediately above.

Table 11. Supply Equations for Secondary Vocational Teachers in Tennessee, by Type of Program, 1966-67

Program	Constant	Years of Schooling E	Years of Experience X	Alternative Earnings W	Quantity of Teachers Q[a]	Standard Error	R^2	Observations
Vocational Agriculture	-2832.61	455.74 (143.11)[b]	36.77 (7.43)	4.92 (1.01)	67.66 (37.34)	478.04	.48	91
Home Economics	359.37	275.55 (166.97)	28.51 (6.03)	2.81 (.72)	29.09 (5.49)	333.25	.56	88
Trades and Industry	3779.86	89.29 (82.04)	36.35 (8.51)	2.19 (1.20)	30.91 (8.49)	443.61	.52	55
Distributive	-10134.00	909.26 (388.45)	30.40 (26.12)	4.80 (1.66)	36.69 (45.37)	511.70	.58	31
Business and Office	8493.47	-202.79 (319.79)	74.18 (16.46)	.78 (1.87)	38.61 (29.64)	499.54	.65	27

[a]Quantity predicted from first-stage regression equation.

[b]Number in parentheses is the standard error corresponding to the coefficient immediately above.

The estimated supply equations for Georgia and Tennessee were highly elastic as were supply equations for North Carolina (Tables 12 and 13). There was a high degree of uniformity in supply schedules for Tennessee vocational teachers (Figure 3). Supply equations estimated for four vocational programs in Georgia are presented in Figure 4.

Table 12. Supply Elasticities for Average Salary and Quantity of Vocational Teachers Per County in Georgia, by Program, 1966-67

Program	Elasticity	Average Price	Average Quantity
		(dollars per year)	
Vocational Agriculture	59.66	7,944	2.17
Home Economics	117.91	6,705	3.59
Distributive	43.64	7,031	2.32
Business and Office	29.45	7,018	1.73

Table 13. Supply Elasticities for Average Salary and Quantity of Vocational Teachers Per County in Tennessee, by Program, 1966-67

Program	Elasticity	Average Price	Average Quantity
		(dollars per year)	
Vocational Agriculture	33.24	6,703	2.98
Home Economics	41.68	6,136	5.06
Trades and Industry	41.91	6,335	4.98
Distributive	76.78	6,283	2.23
Business and Office	67.96	6,219	2.37

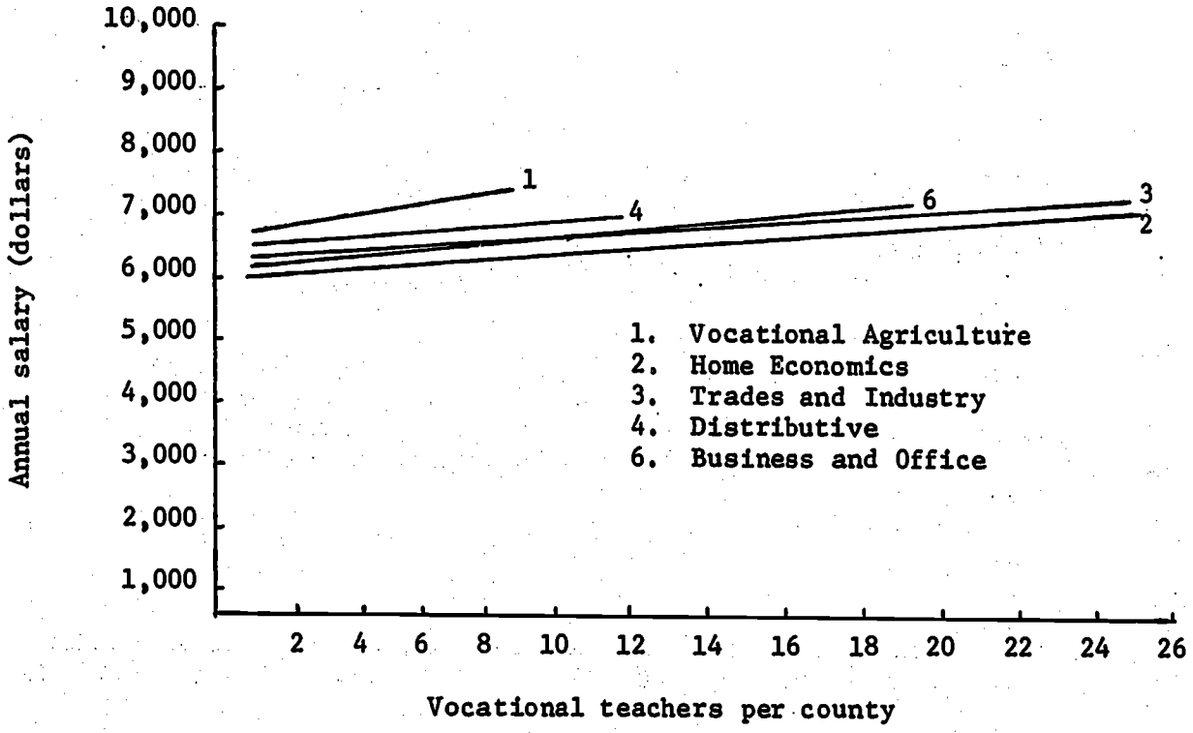

Figure 3. County Supply of Secondary Vocational Teachers in Tennessee, 1966-67

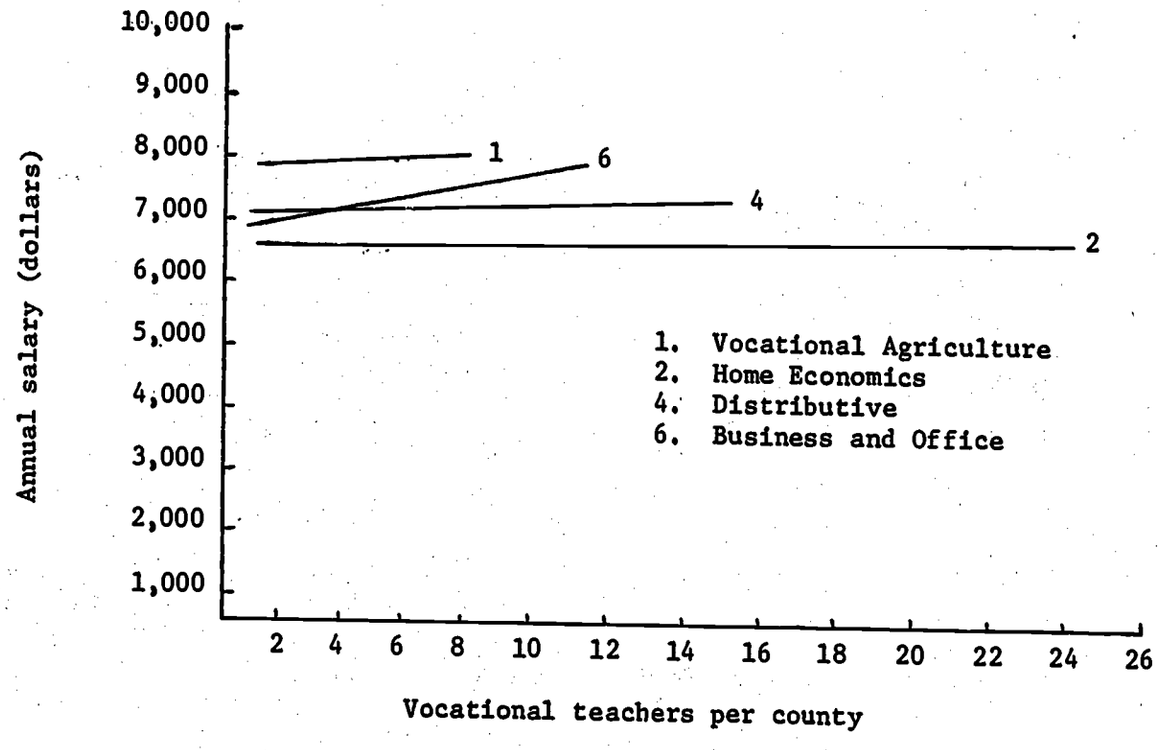

Figure 4. County Supply of Secondary Vocational Teachers in Georgia, 1966-67

Based on the results of this three-state analysis of secondary vocational teachers, it is clear that an economic model of demand for and supply of teachers can be developed and estimated. Economic variables play an important role in the functioning of these markets for teacher services. However, care should be exercised in using results from this study in detailed and specific educational planning because inconsistent signs and relatively low levels of significance were obtained for the economic variables in some equations.

IMPLICATIONS

The first objective of this study was to develop a model of the market for teacher services. As an initial step, the economic concepts of supply and demand were defined and discussed. Failure to understand these concepts can easily prevent educational administrators and planners from recognizing relevant economic factors that alter the supply of or demand for teachers. Increased understanding of the economic determinants of the demand and supply for teacher services is likely to lead to more agreement regarding the effects of alternative policies for teacher markets.

In developing a model of the market for teacher services, an attempt was made to specify the variables which should be included in the supply and demand equations. Discussion of the variables should aid educational planners in identifying factors that might be, but generally are not, included in demand or supply projections. For example, opportunity cost is the single determinant of supply of those teachers already qualified. Cost of qualifying to teach is a fixed cost. For this reason, financial aid to college students who are prospective teachers may have little impact on the future flow of teacher services, unless the conditions of repayment are more favorable to the recipient if he or she chooses to teach after completing college.

If the repayment conditions are made more favorable to the recipient who takes a teaching job, the net effect is simply to add a monetary fringe benefit to the salary that can be earned by the recipient if he chooses to teach. If the initial benefit is sufficiently large, some college graduates who would otherwise find nonteaching jobs that were more financially rewarding may be induced to teach. Likewise, when the benefit is diminished or otherwise becomes insufficient to make teaching equally or more attractive than competitive jobs, the teachers usually gained by such a program will take other employment.

The second objective of this study was to obtain empirical measures of the supply and demand relationships for the services of secondary vocational teachers. The estimates obtained were generally consistent with economic theory. Quantity and price were negatively related in 10 of the demand equations estimated, and a positive relationship between quantity and related employment was obtained in 12 of the 15 demand equations. The supply schedules estimated were more consistent with economic theory than were the demand equations. Price and quantity were positively related in 13 of the 15 supply equations, while price and the opportunity cost variable were positively related in 14 of the 15 equations.

A continuing problem confronted in this study was the lack of appropriate data. Related employment is less appropriate for measuring the investment value of a particular type of vocational training than rate of return, capital gains or the increase in lifetime earnings. With either of these three measures of the investment value of vocational education, the estimated demand equations might be more consistent with economic theory.

Student population (S) and employment in related occupations (N) were highly correlated in all three states, particularly for vocational programs which were offered in a relatively low proportion of the counties (see Appendix). In future studies of demand for secondary vocational teachers, the possibility that the true relationship is nonlinear or requires a different formulation of S as well as of N should be explored. The high inter-correlation between S and N could have caused the coefficients to be nonsignificant in some cases, even though the R^2's were quite reasonable for most of the equations, considering the fact that cross-sectional data were used (Goldberger, 1968, pp. 79-83, 132-133).

The supply estimates obtained might be improved further if a more accurate measure of opportunity cost could be found to replace the three variables used. In the absence of a single measure, the variables used gave results which are encouraging. Two measures of quality that can be associated with opportunity costs, years of schooling, and years of teaching or related experience, were in the supply equation. Thus, the estimated positive relationship between price and quantity was net of the effects associated with education and experience. However, there are some factors which are indicative of a teacher's ability that could not be included in the model for lack of resources. Counties which hire larger quantities of teachers might also attempt to employ higher quality teachers in terms of education, experience, and other factors.

For example, counties which pay higher salaries may be able to hire from among the qualified teachers those who have the best recommendations and personality, had the highest grades in college, did well in practice teaching, etc. It should be understood, however, that such characteristics tend also to reflect a person's value for jobs other than teaching. Hence, hiring more able teachers may require higher salaries because the opportunity cost for such persons would be higher. Thus, it is doubtful that trying to standardize for all quality differences among teachers is really desirable. Quality differences are related to different levels of opportunity cost among teachers. Variation in the opportunity cost of teaching school is the only reason a short-run supply curve for teachers would be expected to have a positive slope. Otherwise the supply curve would be perfectly elastic up to the point where all qualified teachers are hired, and perfectly inelastic at that point.

The results obtained in this study indicate the importance of economic variables in developing models of the demand for and supply of teacher services and demonstrate the difficulties involved in measuring the relationships involved. This study should be considered as an initial effort which will, hopefully, stimulate and contribute to formulation and

testing of other teacher supply and demand models. Proper use of the terms supply and demand according to their economic meaning, combined with additional efforts to measure both, will help to illustrate rather than obscure the important characteristics of the teacher market--a prerequisite to appropriate policies for obtaining highly qualified teachers to fill positions in the classrooms.

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APPENDIX

Table 14. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Vocational Agriculture Teachers in North Carolina, 1965-66

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	816.82	639.11	Q	6.36	4.23
E	16.47	.48	Q^a	6.32	3.63
X	10.12	2.00	P	7417.10	499.63
S	3381	3357	P^a	7416.59	483.30
W	257.02	39.76			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.01	-.07	.30	-.16	.81	-.07
E		1.00	.50	-.01	.04	-.08	.55
X			1.00	.12	.19	-.05	.91
S				1.00	.47	.48	.38
W					1.00	.07	.24
Q^a		-.10	-.06		.08		.0008
P^a	-.07			.39		.0006	

[a]Values predicted from first-stage regression equation.

Table 15. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Home Economics Teachers in North Carolina, 1965-66

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	816.54	644.69	Q	7.94	5.28
E	16.26	.33	Q^a	7.89	4.98
X	8.42	2.47	P	6055.20	515.82
S	3400	3370	p^a	6054.73	471.52
W	257.13	39.86			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.03	.02	.30	-.16	.59	.08
E		1.00	.29	.20	.02	.13	.46
X			1.00	.04	-.04	.00	.82
S				1.00	.47	.84	.40
W					1.00	.39	.15
Q^a		.15	.01		.43		.32
p^a	.09			.44		.32	

[a]Values predicted from first-stage regression equation.

Table 16. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Trades and Industry Teachers in North Carolina, 1965-66

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	7.46	8.47	Q	5.74	5.28
E	14.12	1.48	Q^a	5.72	3.93
X	7.04	2.39	P	5839.38	702.91
S	4053	3553	P^a	5851.13	584.02
W	263.24	38.83			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.34	.27	.84	.70	.69	.49
E		1.00	.39	.34	.25	.16	.59
X			1.00	.33	.23	.12	.72
S				1.00	.44	.71	.54
W					1.00	.45	.40
Q^a		.21	.15		.61		.42
P^a	.58			.63		.37	

[a]Values predicted from first-stage regression equation.

Table 17. Averages, Standard Deviations and Simple Correlations for Variables Used in Demand and Supply of Distributive Education Teachers in North Carolina, 1965-66

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	4398	5223	Q	2.70	2.97
E	16.39	.63	Q^a	2.66	2.78
X	6.30	3.61	P	6071.70	2655.81
S	4647	3688	P^a	6071.25	971.92
W	268.67	39.41			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.17	.11	.97	.38	.92	.04
E		1.00	.35	.22	.01	.02	.27
X			1.00	.12	.23	.05	.29
S				1.00	.40	.88	.06
W					1.00	.49	.17
Q^a		.03	.06		.52		.02
P^a	.12			.16		.06	

[a]Values predicted from first stage regression equation.

Table 18. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Diversified and Comprehensive Education Teachers in North Carolina, 1965-66

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	19.33	30.04	Q	2.94	2.01
E	15.73	1.23	Q^a	2.89	1.17
X	6.28	2.82	P	5217.63	541.94
S	3667	2930	P^a	5217.13	457.44
W	261.96	38.55			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.13	.02	.94	.40	.56	.32
E		1.00	.20	.09	.09	-.05	.12
X			1.00	-.04	.05	-.08	.78
S				1.00	.36	.55	.25
W					1.00	.26	.09
Q^a		-.09	-.14		.44		.19
P^a	.38			.29		.13	

[a]Values predicted from first-stage regression equation.

Table 19. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Vocational Agriculture Teachers in Georgia, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	2701.33	1767.89	Q	2.17	1.00
E	16.34	.38	Q^a	2.11	.68
X	16.19	7.27	P	7944.03	742.57
S	1456	2982	p^a	7943.52	560.80
W	251.13	40.88			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	-.10	.15	.01	-.18	.67	.01
E		1.00	-.01	-.01	.03	-.02	.54
X			1.00	.15	.00	.13	.38
S				1.00	.44	.04	.35
W					1.00	-.04	.32
Q^a		-.02	.19		-.06		.10
p^a	.01			.46		.09	

[a]Values predicted from first-stage regression equation.

Table 20. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Home Economics Teachers in Georgia, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	11.10	7.67	Q	3.59	3.31
E	16.24	.32	Q^a	3.54	2.24
X	13.57	5.95	P	6705.31	659.28
S	1657	3381	P^a	6704.80	510.65
W	253.15	40.83			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.13	.02	.67	.57	.67	.21
E		1.00	.21	.20	-.03	.12	.43
X			1.00	.09	-.10	-.00	.64
S				1.00	.47	.54	.36
W					1.00	.42	.20
Q^a		.18	-.00		.62		.25
P^a	.27			.47		.22	

[a]Values predicted from first-stage regression equation.

Table 21. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Trades and Industry Teachers in Georgia, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	527.73	896.17	Q	2.86	4.08
E	16.2	1.10	Q^a	2.80	3.80
X	13.94	8.21	P	7843.86	970.88
S	2966	5150	p^a	7843.38	807.29
W	269.74	40.02			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	-.22	.04	.98	.53	.78	-.13
E		1.00	.50	-.27	-.29	-.62	.71
X			1.00	.01	-.07	-.08	.67
S				1.00	.48	.82	-.20
W					1.00	.39	-.03
Q^a		-.66	-.09		.42		-.44
p^a	-.16			-.24		-.49	

[a]Values predicted from first-stage regression equation.

Table 22. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Distributive Education Teachers in Georgia, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	980.89	1641.44	Q	2.32	2.91
E	16.15	.30	Q^a	2.27	2.87
X	9.53	9.32	P	7031.14	1090.14
S	5319	6528	P^a	7030.59	832.31
W	295.00	40.33			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	-.07	.08	.98	.39	.97	.24
E		1.00	.55	-.06	-.03	-.04	.58
X			1.00	.12	.10	.01	.63
S				1.00	.45	.96	.29
W					1.00	.42	.26
Q^a		-.04	.01		.42		.24
P^a	.32			.39		.30	

[a]Values predicted from first-stage regression equation.

Table 23. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Business and Office Education Teachers in Georgia, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	55.45	108.75	Q	1.73	2.01
E	16.00	1.01	Q^a	1.63	1.70
X	10.93	7.65	P	7017.88	878.46
S	4714	6848	p^a	7017.35	578.87
W	289.04	38.57			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.11	.12	.98	.51	.82	.42
E		1.00	.12	.06	-.17	-.06	-.11
X			1.00	.10	-.12	.21	.44
S				1.00	.60	.81	.41
W					1.00	.46	.36
Q^a		-.08	.25		.54		.51
p^a	.64			.63		.66	

[a]Values predicted from first-stage regression equation.

Table 24. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Vocational Agriculture Teachers in Tennessee, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	6.22	3.66	Q	2.98	1.91
E	16.35	.37	Q^a	2.92	1.36
X	16.46	7.23	P	6703.22	642.29
S	2382	5099	P^a	6702.68	513.63
W	260.20	50.25			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	-.01	.01	.25	-.04	.66	.00
E		1.00	.35	.10	-.03	.01	.40
X			1.00	.12	-.08	.03	.48
S				1.00	.31	.40	.59
W					1.00	.10	.36
Q^a		.01	.04		.14		.22
P^a	.00			.74		.19	

[a]Values predicted from first-stage regression equation.

Table 25. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Home Economics Teachers in Tennessee, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	18.14	13.27	Q	5.06	7.68
E	16.19	.25	Q^a	5.01	6.75
X	15.15	6.97	P	6136.27	486.70
S	2591	5379	P^a	6135.74	366.40
W	261.85	52.07			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.10	-.04	.82	.76	.44	.44
E		1.00	.53	.13	-.01	.10	.39
X			1.00	.04	-.03	-.04	.46
S				1.00	.87	.31	.53
W					1.00	.25	.41
Q^a		-.01	-.03		.28		.47
P^a	.58			.71		.55	

[a]Values predicted from first-stage regression equation.

Table 26. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Trades and Industry Teachers in Tennessee, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	922.87	2371.60	R	.94	.32
E	15.81	.77	Q	4.89	8.28
X	10.87	7.47	Q^a	4.84	7.52
S	3592	6582	P	6334.89	612.27
W	273.15	53.04	P^a	6334.42	445.47

Simple Correlations

	N	E	X	S	W	R	Q	P
N	1.00	-.05	.16	.98	.26	.11	.90	.50
E		1.00	.31	-.02	.13	.33	.02	.28
X			1.00	.13	.02	.38	.12	.53
S				1.00	.29	.09	.91	.48
W					1.00	-.00	.29	.34
R						1.00	.10	.25
Q^a		.02	.13		.32			.50
P^a	.69			.66		.34	.63	

[a]Values predicted from first-stage regression equation.

Table 27. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Distributive Education Teachers in Tennessee, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	2896.45	6530.58	Q	2.23	2.59
E	16.23	.37	Q^a	2.17	2.30
X	7.35	5.95	P	6283.32	727.33
S	4946	8481	P^a	6282.81	604.67
W	283.74	60.50			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.12	.18	.99	.22	.82	.42
E		1.00	.77	.09	-.17	.17	.61
X			1.00	.16	-.22	.29	.56
S				1.00	.26	.85	.38
W					1.00	.21	.29
Q^a		.19	.33		.24		.39
P^a	.50			.46		.42	

[a]Values predicted from first-stage regression equation.

Table 28. Averages, Standard Deviations and Simple Correlations for Variables Used in Analysis of Demand and Supply of Business and Office Education Teachers in Tennessee, 1966-67

Variable	Average	Standard Deviation	Variable	Average	Standard Deviation
N	7075	11321	Q	2.37	3.63
E	16.31	.43	Q^a	2.32	3.39
X	9.74	8.45	P	6218.70	759.78
S	5286	8975	P^a	6218.15	634.06
W	281.07	54.48			

Simple Correlations

	N	E	X	S	W	Q	P
N	1.00	.20	.30	.98	.33	.85	.48
E		1.00	.71	.16	.10	.02	.48
X			1.00	.25	.20	.11	.78
S				1.00	.26	.91	.41
W					1.00	.25	.26
Q^a		.03	.12		.27		.28
P^a	.57			.49		.32	

[a]Values predicted from first-stage regression equation.

Table 2. First-Stage Regression Equations with Quantity and Price Regressed on the Other Variables in the Model, by Vocational Subject, Georgia, 1966-67

Program	Dependent Variable	Constant	N	E	X	S	W	Standard Error of Regression	R^2	Observation
Vocational Agriculture	Q	-1.50	.00038 (.00004)[a]	.12487 (.16405)	.00351 (.00874)	-.000002 (.000024)	.00210 (.00172)	.75	.46	145
	P	-11263.00	.02 (.02)	1072.91 (109.06)	35.33 (5.81)	.05 (.02)	3.88 (1.15)	497.06	.57	
Home Economics	Q	-4.46	.23283 (.03965)	.290 (.673)	-.01522 (.03601)	.00015 (.00009)	.00279 (.00639)	2.48	.46	143
	P	-4548.90	-10.61 (6.91)	584.23 (115.63)	64.53 (6.18)	.04 (.01)	3.69 (1.10)	426.02	.60	
Trades and Industry	Q	35.08	-.00045 (.00170)	-2.01101 (.28532)	.08939 (.0351)	.00064 (.00028)	-.00948 (.00782)	1.59	.87	42
	P	-1047.06	.60 (.63)	431.91 (104.82)	49.81 (12.90)	-.13 (.11)	4.75 (2.88)	582.63	.69	
Distributive	Q	-14.85	.00122 (.00053)	.92661 (.57718)	-.04210 (.01918)	.00013 (.00014)	.00240 (.00411)	.66	.96	22
	P	-18680.00	-.60 (.67)	1499.15 (717.86)	38.11 (23.86)	.19 (.17)	2.48 (5.12)	825.61	.58	
Business and Office	Q	4.86	.01666 (.01282)	-.32716 (.24954)	.03791 (.03236)	-.00003 (.00021)	.00318 (.00921)	1.22	.71	26
	P	6214.52	8.66 (7.91)	-139.82 (153.91)	53.51 (19.96)	-.12 (.13)	8.72 (5.68)	753.43	.43	

[a]Number in parentheses is the standard error corresponding to the coefficient immediately above.